ARJUNA

JEE

LECTURE - 10

Mole Concept

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"कुछ लोगों का सफल होने का सपना होता है जबकि कुछ लोग सुबह उठकर उस पर काम करने लग जाते हैं।" – मार्क जुकरबर्ग

Target - AIR ⇒ 1 to 10 Adv

MAINS ⇒ 100% - 99.5%

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Q. Calculate the mole fraction of NaOH in 10% (w/w) solution of NaOH

10% (w/w): solute, solution

Ans batao

(A) 1/21

(B) 1/5

(C) 1/11

(D) 1/10

$W_{NaOH} = 10$ gram

$W_{Soln} = 100$ gram

$W_{H_2O} = 100 - 10 = 90$ gram

$$\chi_{NaOH} = \frac{n_{NaOH}}{n_{NaOH} + n_{H_2O}}$$

$$= \frac{\frac{10}{40}}{\frac{10}{40} + \frac{90}{18}}$$

$$= \frac{0.25}{0.25 + 5} = \frac{0.25}{5.25}$$

$$\chi_{NaOH} = \frac{1}{21}$$

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MOLE FRACTION

$C_{SD} = 29$

① $X_1 = \frac{n_1}{n_1 + n_2}$

② $X_2 = \frac{n_2}{n_1 + n_2}$

(3) $X_1 + X_2 = 1$

(4) $\boxed{\frac{X_1}{X_2} = \frac{n_1}{n_2}} = \frac{\frac{W_{solute}}{(m.wt)_{solute}}}{\frac{W_{solvent}}{(m.wt)_{solvent}}}$

$\frac{X_1}{X_2} = \frac{W_{solute}}{W_{solvent}} \times \frac{(m.wt)_{solvent}}{(m.wt)_{solute}}$

⑤ If mole fraction$_{solute}$ = given

① mole fraction solvent =

② mole ke ratio bhi given hai $\frac{X_1}{X_2} = \frac{n_1}{n_2}$

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Q mole fraction of glucose in aqueous solution of glucose is 0.4.

(a) Calculate mole fraction of H_2O = $X_{gly.} + X_{H_2O} = 1$, $X_{H_2O} = 1 - 0.4 = 0.6$

(b) Calculate ratio of mole of glucose and H_2O = $\frac{n_{gly}}{n_{H_2O}} = \frac{X_{gly}}{X_{H_2O}} = \frac{0.4}{0.6}$

$\left(\frac{n_{gly}}{n_{H_2O}} = ?\right)$

$$\frac{n_{gly}}{n_{H_2O}} = \frac{2}{3}$$

Q glucose ----- and H_2O present in a Container → 2:3 molar ratio

Calculate mole fraction of glucose in solution

(a) 0.6

(b) 0.8

(c) 1.7

✓(d) None of these

$$X_{glu} = \frac{n_{glu}}{n_{glu} + n_{H_2O}}$$

Sol^n ⇒

$$\frac{X_{glu}}{X_{H_2O}} = \frac{n_{glu}}{n_{H_2O}} = \frac{2}{3}$$

$$\frac{X_{glu}}{1 - X_{glu}} = \frac{2}{3} \quad \left(\because X_{glu} + X_{H_2O} = 1 \right)$$

$$3X_{glu} = 2 - 2X_{glu}$$

$$X_{glu} = \frac{2}{5} = 0.4$$

$C_{SD} = 30$

yadi Ratio diya jaye aur Ratio puchha jaye, to Ratio Ko absolute value maan liya Karo.

(M-2) → $\frac{n_{gly}}{n_{H_2O}} = \frac{2}{3}$, $n_{gly} = 2$, $n_{H_2O} = 3$

$X_{gly} = \frac{2}{2+3} = \frac{2}{5} = 0.4$

Q Mass ratio of NaOH and H_2O in aqueous solution of NaOH is 4:5, Calculate Mass % of NaOH and also find out mole fraction of NaOH

$\Rightarrow$ Mass % of NaOH $= \frac{W_{NaOH}}{W_{NaOH}+W_{H_2O}} \times 100$

Sol^n $\Rightarrow$ $W_{NaOH} = 4$ gram

$W_{H_2O} = 5$ gram

Mass % of NaOH $= \frac{4}{4+5} \times 100 = \frac{4}{9} \times 100 = \frac{400}{9}$

$\Rightarrow X_{NaOH} = \frac{\eta_{NaOH}}{\eta_{NaOH}+\eta_{H_2O}}$

$X_{NaOH} = \frac{\frac{4}{40}}{\frac{4}{40}+\frac{5}{18}} = \frac{0.1}{0.1+0.27} = \frac{0.1}{0.37} = \frac{10}{37}$

Q. Mole fraction of NaOH in aq. Solution of NaOH is 0.4 than calculate mass% of NaOH?

$$\frac{\chi_{NaOH}}{\chi_{H_2O}} = \frac{n_{NaOH}}{n_{H_2O}}$$

$\chi_{NaOH} = 0.4$

$\chi_{H_2O} = 1 - 0.4 = 0.6$

$$\frac{n_{NaOH}}{n_{H_2O}} = \frac{0.4}{0.6} = \frac{2}{3}$$

$n_{NaOH} = 2$, $w_{NaOH} = 2 \times 40$

$n_{H_2O} = 3$, $w_{H_2O} = 3 \times 18$

Mass % of NaOH

$$= \frac{w_{NaOH}}{w_{NaOH} + w_{H_2O}} \times 100$$

$$= \frac{2 \times 40}{2 \times 40 + 3 \times 18} \times 100$$

$$= \frac{80}{80 + 54} \times 100$$

$$= \frac{80 \times 100}{134} = 59.7\%$$

Q Mole fraction of water in aqueous solution of HCl is 0.8
Select correct option

(a) Mole fraction of HCl = 0.2

(b) Mole ratio of HCl and water = 1:4

$$\frac{x_{HCl}}{x_{H_2O}} = \frac{0.2}{0.8} = \frac{1}{4} = \frac{n_{HCl}}{n_{H_2O}}$$

(c) 'a' & 'b' both correct

(d) Mole fraction of HCl = 0.4

Q Mole fraction of water in aqueous solution of HCl is 0.8
Select correct option (one or more than one Ans correct)

(a) Mole % of HCl = 20%
0.2×100 = 20%

(b) ✗ Mass % of HCl = 23.5%

(c) ✗ Mole % of HCl = 40%

✗ (d) None of these

Cl = 35.5
H = 1
HCl = 36.5

→ Mole % = Mole fraction × 100

→ $X_{HCl} = 0.2$, $X_{H_2O} = 0.8$

$$\frac{n_{HCl}}{n_{H_2O}} = \frac{0.2}{0.8} = \frac{1}{4}$$

$n_{HCl} = 1$, $W_{HCl} = 1 \times 36.5$ gram

$n_{H_2O} = 4$, $W_{H_2O} = 4 \times 18$ gram

$$\text{Mass \% of HCl} = \frac{w_{HCl}}{w_{HCl} + w_{H_2O}} \times 100$$

$$= \frac{36.5}{36.5 + 4 \times 18} \times 100$$

$$= 33.6\ \%$$

Volume percentage (% (v/v))

total volume of solute present in 100ml of solution.

$$\text{Volume \% of solute} = \frac{\text{Volume of solute}}{\text{Volume of soln.}} \times 100 = \frac{V_1}{(V_1+V_2)} \times 100$$

Suppose → V_1 ml = vol. of solute

V_2 ml = vol. of solvent

(V_1+V_2) ml = vol. of solution

Q 20 ml Acetone dissolved in 40 ml water

Calculate volume % of acetone in solution

(a) 33.3 %

(b) 66.67 %

(c) 25 %

(d) None of these

$$\text{Volume \% of Acetone} = \frac{V_{Acetone}}{V_{Acet} + V_{H_2O}} \times 100$$

$$= \frac{20}{20+40} \times 100$$

$$= \frac{20}{60} \times 100$$

$$= \frac{1}{3} \times 100 = 33.3\ \%$$

Q. 100 ml ethyl alcohol mixed with 500 ml water in a container calculate volume percentage of ethyl alcohol.

Ans batao

A 20%

B 15%

C 15.75%

D 16.67%

$$\text{Vol. \% of ethyl alcohol} = \frac{V_e}{V_e + V_{H_2O}} \times 100$$

$$= \frac{100}{100+500} \times 100$$

$$= \frac{1}{6} \times 100 = 16.67\%$$

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Mass by volume percentage ((w/v)%)

total amount of solute (gram) present in 100ml of solution

Mass by volume percentage or % (w/v)

$$= \frac{\text{Mass of solute}}{\text{Vol. of sol}^{n}} \times 100$$

Q 18 gram glucose dissolved 400ml solution. Calculate mass by volume percentage of glucose.

(a) 45%.

(b) 4.5%. ✓✓

(c) 90%.

(d) None of these

$$\%(w/v) = \frac{\text{Mass of glucose}}{\text{Vol. of soln.}} \times 100$$

$$= \frac{18}{400} \times 100$$

$$= \frac{9}{2} = 4.5\%$$

Q. 40 gram sugar dissolved in 200 ml water. Calculate concentration of sugar solution in terms of mass by volume percentage [(W/V)%]

A 20% ✓✓

B 25%

C 30%

D 22%

$$(W/V)\% = \frac{40}{200} \times 100$$

$$= \frac{40}{2} = 20\%$$

Effect of temperature in Concentration

→ only temperature effect volume of liquid or solution

$C_{SD} = 31$

temp. ∝ volume of liq. or solution

temp. – not effected → mass, mole } x

Q. Which Con. term effected by temp.

(a) Mass %.

(b) (w/v) %. ✓

$$\text{Mass \%} = \frac{w_1}{w_1 + w_2} \times 100$$

Q How many Concentration term is not effected by temperature

(w|w) %, (w|v) %, (v|v) %, Mole fraction, Mole %,

(a) 2

(b) 3

(c) 4

(d) 1

Home work

① → DPP. - NO. = 7

② → Concentration Ke C_{S_D}

Thank - You